

XTAL SET SOCIETY  
Books, Kits, Parts  
YOUR JANUARY 2015  
NEWSLETTER IS ENCLOSED

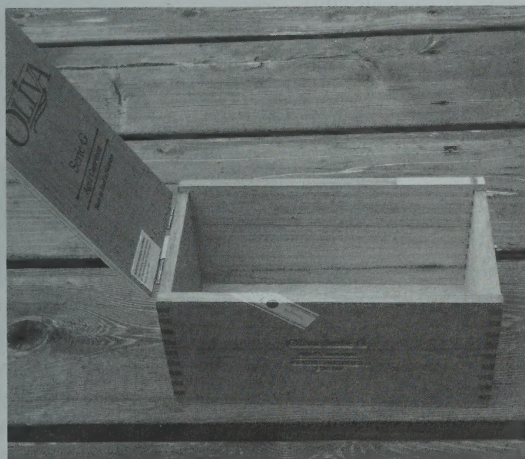
## GETTING BACK TO BASICS

FIND US ON FACEBOOK  
XTALSETSOCIETY

### Cigar Box Radio Contest

Build a cigar box radio and submit your picture, schematic, and any other information of your choosing. The Crystal Queen will determine the two best to be displayed in the March 2015 newsletter.

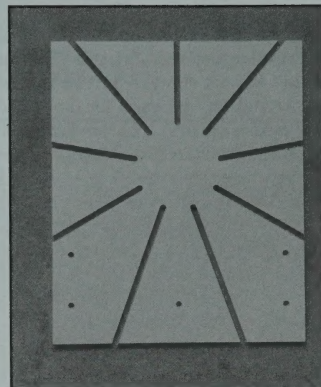
If you do not have access to a cigar box, go to our website and see our specials page where we show the boxes we have found or send me your order for it.



Oliva Ciger Box \$5.95

### Spider Coil Form

This 5 by 6 by 1/8<sup>th</sup> inch ABS plastic form includes nine NC punched radial slots and five mounting holes. The inner diameter is 1.6 inches and the outer diameter extends to the edge of the form, 5.0 inches. This size supports 250 uH coils (good for the AM band) when used with #22 or #26 enamel, or 150/45 Litz wire using 56 turns of 150/45 Litz, with a 1.6 inner diameter and 4.2 outer diameter. Weight of the form itself is 2 oz. An instruction sheet including formula and table ships with the form. In addition, you'll find the spider formulas for number of turns for a given inductance on our formulas-calculators web page on our main site, [www.midnightscience.com](http://www.midnightscience.com) #22 and #26 enamel coated wire and 150/46 Litz wire are also listed on our parts page on the web. Spider Coil Form Cat #SpCO \$9.95 each.

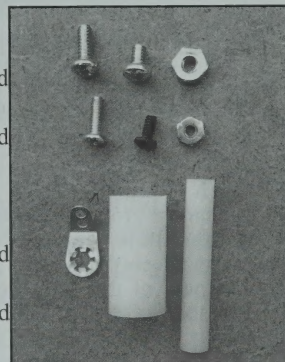


### Connector Assortment

The assortment includes:  
6, 6-32x3/8 inch Phillips-head screws,  
6, 6-32x1/4 inch Phillips-head screws,  
12, 6-32 hex nuts for the above,  
6, 4-40x3/8 inch Phillips-head screws,  
6, 4-40x1/4 inch Phillips-head screws,  
12, 4-40 hex nuts for the above,  
6, #6 solder lugs,  
2, 1-inch by 1/2 inch nylon shafts with interior 1/4 inch opening,  
2, 1.5-inch by 1/4 inch nylon shafts.

You can use a screw, solder lug, and hex nut to provide a ground connection on the frame and rotor plates of our air variable capacitors. You can use a pair of the nylon shafts by drilling and tapping two holes in the larger shaft for interconnection with the cap shaft and the smaller nylon extender. This enables you to mount the cap away from the front panel.

Cat# Connect assort 3.95





## THE XTAL SET SOCIETY

e-mail: [xtalset@sunflower.com](mailto:xtalset@sunflower.com)

We are dedicated to once again building and experimenting with radio electronics, often—but not always—through the use of the crystal set, the basis for most modern day radio apparatus. This newsletter helps support our goal of producing excellent quality technical books that encourage learning and building. To join the society and receive one year of the bi-monthly newsletter, remit \$14.95 to The Xtal Set Society. Canadians, please remit US \$15.95. Outside the US and Canada please remit US \$21.95.

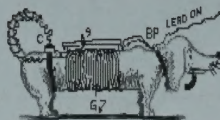
Please send articles and correspondence to the address below. NOTE: Unless otherwise stated, The Society assumes that the material you supply is fit for print (free of copyright or other infringements) and that by your submittal you have given us your permission to print the material without restriction.

Founder & Columnist— Philip N. Anderson, W0XI

Editor & Queen Mum— Patricia, N0GZZ

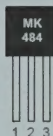
Columnist— J.K. Fenton

Columnist— Dan Petersen, W7OIL



### MK-484 TRF AM Radio Chip in TO-92 Pack

The MK484 is an offshoot of the famous Ferranti ZN-414 and is a tuned radio frequency (TRF) radio in a small TO-92 transistor-like package. Combined with (these parts not included) three resistors, three capacitors, an ear phone, 1.5V battery, tuning coil and tuning capacitor, you can make an AM receiver for the AM band and up to 3 MHz. See our article in the July issue of our newsletter for a circuit example with details. Suggested schematic with parts list sent with each IC (chip). Cat# XSMK \$2.49



### Mini MK484 Radio Kit

No antenna or ground required!

This “mini” kit is a subset of the MK484 AM Radio kit and uses a small portion of the printed circuit board of that kit. The MINI features the MK484 IC, a ferrite rod antenna, a 1.5 volt regulator, a handful of resistors and capacitors, an on-off switch, variable capacitor, panel, chassis, and crystal radio earpiece. The set does not need an antenna or ground since it includes the ferrite rod; does not need a volume control since it has built in gain control, and the earpiece takes the place of headphones. You supply the 9V battery. The radio is set to tune the AM band. MK484 mini \$69.95

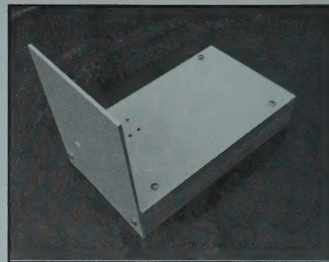


### ABS Panel and Chassis Kit

This kit, includes two precut ABS (low-loss) panels, 5 x 6 x 1/8 and 5 x 8 x 1/8<sup>th</sup> inches; two wood rails each 1.5 by 3/4 by 8 inches long, and six wood screws. No holes are predrilled in the panels or rails. The kit includes mechanical drawings showing dimensions and locations for the holes, including drill-hole patterns for the shaft and mounting of our 365 air variable capacitors. ABS Panel Assembly Kit, Cat #ABSPAK, \$9.95.

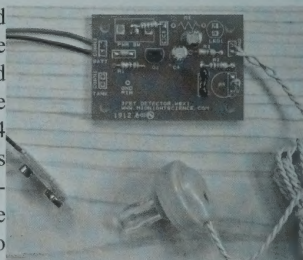
5x6x1/8 ABS Panel, Cat#ABS6 \$ 3.95

5x8x1/8 ABS Panel, Cat#ABS8 \$ 3.95



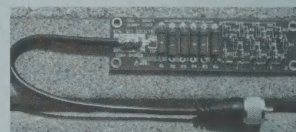
### Infinite Impedance Detector Kit

This kit includes parts and a small PCB to substitute a JFET circuit configured as an infinite impedance detector for the usual 1N34 diode detector. With this replacement, your crystal set will generate more volume and reduce audio distortion. Historically this arrangement was used with a triode tube in early AM radio sets. Ideal for those wishing to listen to AM with improved audio linearity. Kit replaces the diode detector in your crystal or TRF set. Assembly time is about one-half hour. CAT # XSIDK \$19.95.

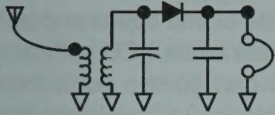


### XS-SDLK (Self Powered) Smart Dummy Load- 10 Watts.

For *QRP Amateur Radio* use. This kit and our passive CW filter kit were inspired by our enthusiasm for non-powered - no batteries - electronics. The “smart” dummy load, assembled on a 1-1/4 by 4-1/2 inch PCB, features a 10-watt dummy load with power levels achieved denoted by four LEDs. The circuit includes six 3-watt metal film resistors, four detector diodes, four zeners, four LEDs, and bias resistors. The four LED circuits denote power achieved: 1, 2, 5, or 10-watts. *The signal measured supplies the power.* No batteries Mom! Assembly time is about 25 minutes. Coax with PL-259 connector not included. XS-SDLK , \$19.95.







# The Xtal Set Society Newsletter

Volume 25, No.1

January 2015

## In this issue (#141) January 2015)

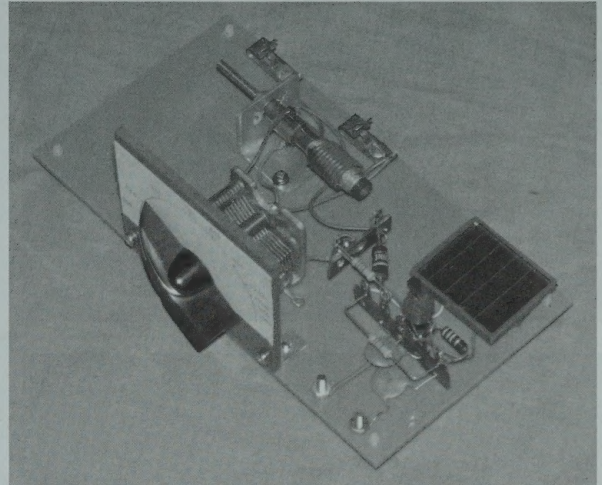
- \* How About Some "Light Listening"
- \* Philmore Slider Set; 1940s-1950s
- \* Finding A Suitable Cabinet for your radio
- \* Installing an Xtal Antenna
- \* Xtal Corner: Member Correspondence

### How About Some "Light Listening"

by Dan Petersen, W7OIL

Back in the "good old days", those years "B.C." which of course meant "Before Computers" I, as a young lad, had several radio parts stores and at least a half-dozen "war surplus" stores to blow my allowance in. Telrad Electronics had loopsticks for 39 cents, capacitors and resistors aplenty and even some of the latest GE transistors that came in their own cardboard box like a vacuum tube. I had to save up for a couple of weeks to get a GE-1 transistor - I seem to recall they were over a dollar...ouch! One of the most coveted components was the solar cell. There were two fairly common types, the B2M selenium solar cell and the S1M silicon solar cell, both made by International Rectifier. The B2M was also spendy at a couple of bucks but the S1M, while the price escapes me was enormously expensive, perhaps four dollars. Remember that my weekly allowance was a princely \$1.00 a week!

So where does this lead? There was a craze going of radios powered by different items you would not normally associate with power generation. There was the lemon battery, the potato battery, the "Chlorox™" battery and the solar cell. Germanium transistors can operate at less than 1/2 volt so battery efficiency was not paramount. So the radio magazines abounded with articles about novel radios and some of the projects even worked! Fast-forwarding to today I shall now describe a



more modern version of the tried and sometimes true sun (or light) powered radio.

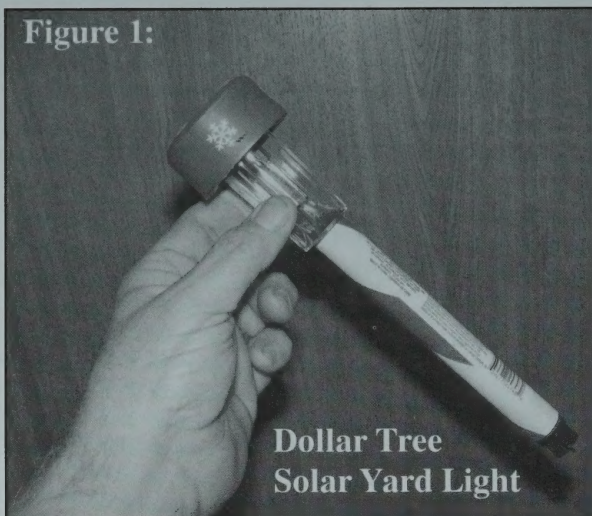
### Let there be light!

The first order of business is to round up a solar cell. This may be easier than you think. A trip to my local "Dollar Tree™" store was all that was necessary as they had some Christmas-themed LED solar yard lights for, you guessed it, a dollar. Figure 1 illustrates the yard light in all its cheap chinese-manufactured glory. The drum-shaped head is what you should be interested in. It comes off with a mere twist from the clear section. the remainder can be discarded unless you can find a use for something that no longer has a use. The bottom of the "drum" is detached from the rest by removing two screws (see Figure 2) and carefully pulling it away. There are two wires between the sections so don't do your "Incredible Hulk" impression while doing this. Broken wires, bad Hulk! No cookie!!

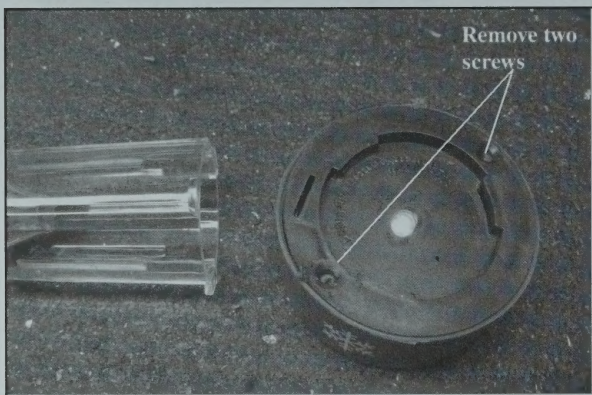
Clip the two little wires leading from the solar panel at the little circuit board containing the LED.



**Figure 1:**

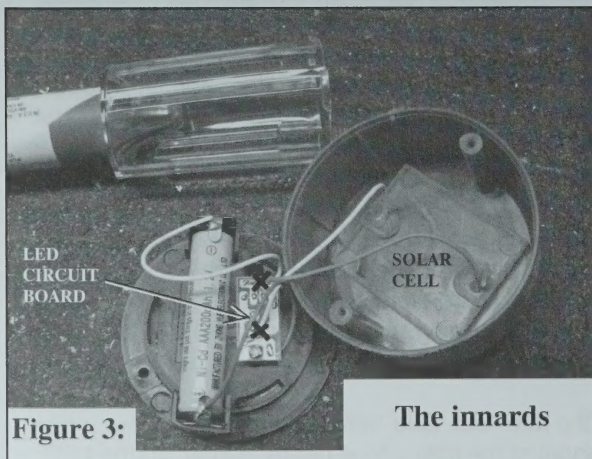
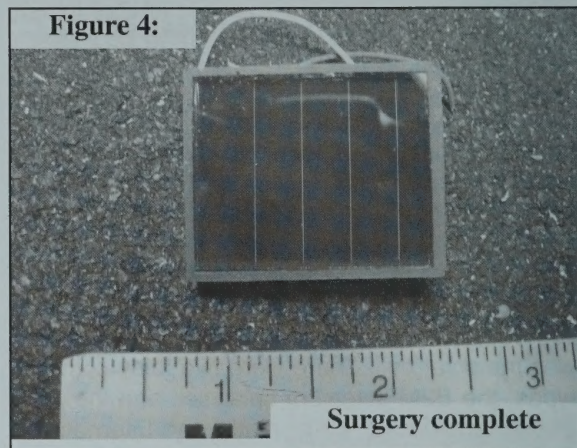


In Figure 3 the two "X's" show where to cut the wires. As an aside I keep the circuit board and battery as the board can drive a white LED with only 1.2 to 1.5 volts. Now you can go two ways from here; either keep the whole "drum" and mount it to your radio using the two existing screw-holes or carefully cut the solar cell away from the rest of the drum, an example shown in Figure 4. I elected to cut the drum part away but I used great caution - I already sank an "X-acto" knife blade into the palm of my hand once this month. My cell had a green and a white wire. The green wire was "negative" and the White "positive". Also, these are technically solar *panels* as they contain more than one *cell*. In full sun these panels put out 3 volts "no-load". The current capability is not great but more than enough for this application.



**Figure 2:**

**Step 1 - Disassembly**



**Figure 3:**

**The innards**

### We Have the Cell, What Now?

The rest of the set is a fairly simple, plain-vanilla one-transistor amplified crystal set. Many of the parts are available from the Xtal Set Society (<http://www.midnightscience.com>) including (for a while until they run out) the "loopstick", the variable capacitor, germanium diode and earphone. The transistor, resistors and fixed capacitors are usually found at Radio Shack or on-line. For the article example I used a piece of "Lexan™" plastic sheet for a baseboard. I happened to have all necessary parts ("OILs" junquebox is *well* stocked) including that scarce loopstick. A note of caution,



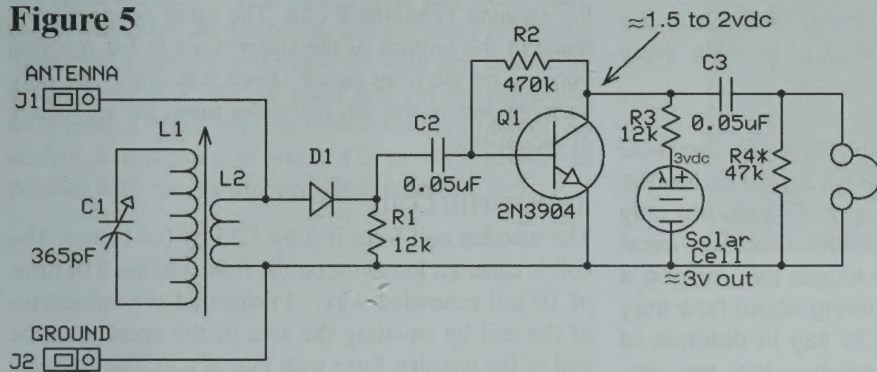
loopsticks are as rare as sneakers for a hippo so if you can get one, fine. Otherwise, you can use a coil with an inductance of around 230 microhenries. A substitute coil can be made from a 3-inch length of 1.5-inch PVC pipe, which an outer diameter of 1.9 inches. Using #24 enameled wire, which the XSS sells, you closewind 84 turns onto the PVC pipe. This will give you a coil of approximately 235 uH inductance.

### And Now...the Rest of the Radio.

The schematic in Figure 5 shows the parts in their proper places. You may note that the tuned circuit L1/C1 is not physically wired to the rest of the circuit. It is instead *mutually coupled* to the rest of the circuit. Why is this? Since the antenna is com-

prised of distributed capacitance and inductance it would have a deleterious effect on the tuned circuit. Tuning is much more selective with this lash-up. You can see that the antenna and ground connections go directly to the link coil L2. Loopsticks usually, when new, have a link coil wound on the outside of the main coil L1 creating a ready-made L2. Connecting the outside world to the link coil minimizes messing up the tuned circuit characteristics. The link coil on the PVC substitute can be made from 6 turns of hookup wire over the center of the coil L1. RF energy is fed to the detector diode, D1, while resistor R1 supplies a load and a DC path for the diode. The detected audio passes through C2 to the base of the transistor Q1. This is shown as a 2N3904 transistor but there are several types that will work as long as they are NPN

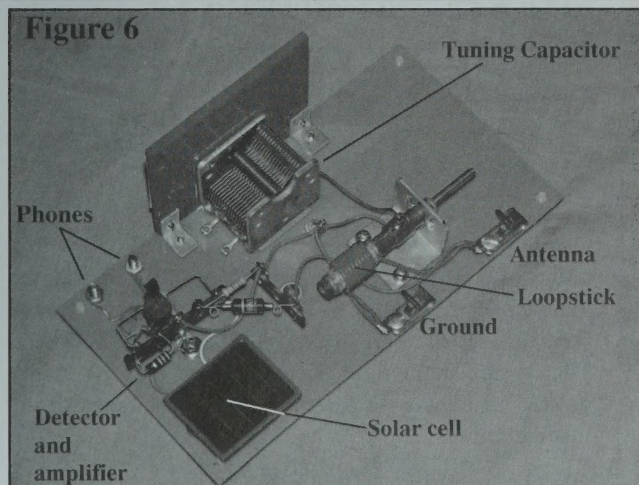
**Figure 5**



\* R4 only required if crystal earphone is used.

types. R3 is the collector load resistor. Now a word about biasing the transistor. The voltage on the collector of the transistor referenced to ground should be about 1/2 what the solar cell is producing. This can be adjusted by changing the value of biasing resistor R2. In my case the magic value was 470k ohms. Try that value first. If the collector voltage

**Figure 6**



needs to go up increase the value of R2 and vice-versa. Amplified audio is conducted to the headphones via C3. Resistor R4 is used if a crystal earphone is used. If high-impedance (>2000 ohm) headphones are used R4 is not necessary but it doesn't adversely affect the performance of the radio if it's still there. Figure 6 points out the major placement of the components. Hot-melt glue holds the solar cell to the base.



## So Does It Work?

The hacks of the 1950's would claim that a radio like this "Would work forever without batteries!". Well, I guess that would be true if you had an eternal source of light! Personally I think "Fusion Reactor Powered Receiving Apparatus" has a nice ring to it. The sun supplies ALL our energy, directly or indirectly.

After connecting this radio to an antenna and ground Fahnestock (FAWN-stock) clips I connected the crystal earphone across R1 so that I could hear the un-amplified audio from the crock-jocks. As I suspected the set worked pretty much like a good quality crystal radio. The listening was good if you didn't mind two other stations in the background competing for your brain-cells. Now for the acid test!

I connected the crystal earphones to the two 6-32 screws used as terminal posts. Wow! A lot louder. Now the crock-jock on the selected was not only annoying he was yelling his blather into my ears! The other two stations were louder too, making a kind of devil's chorus all jibbering about how they can save the world. I have to say in defense of AM in the Portland/Vancouver area that one station plays oldies music (not the McCarthy hearings thank God-wrong "oldies") for your listening enjoyment. I estimate that the amplification is on the order of 15 decibels or a gain of roughly 30. All this time I was powering the radio from a desk lamp with the bulb about 18 inches from the solar cell. Running it from the desk-lamp proves that not much energy is used. In fact I did a quick calculation. I measured the voltage drop across R3 and found it to be 1.2 volts. Divide that by the resistance (12000 ohms) and you get a current of 100 microamps! Pretty tiny stuff. All in all I found this to be an interesting exercise in innovation and experimentation. I hope you do the same.

## Philmore Slider Set: 1940s-1950s

By J.K. Fenton

The Philmore Slider Set as shown in Picture 1 became available in the 1940-1950 era. It is a simple set with a limited number of parts. Phone leads attach to the Fahnestock clips at the upper left; a long-wire antenna attaches to the upper-right clip and system ground to the lower right clip. The Galena detector with cat-whisker is shown at the top. One tunes the station with the slider shown at the bottom.

The various parts are wired together on the back side as shown in Picture 2 with metal strips. Thus the set required no soldering. At close inspection, one can see that the coil, wound on a piece of wood, has only one connection to the antenna terminal via a screw to the antenna Fahnestock clip. The other connection is made at the bottom of the slider through the rounded opening on the front panel. Given that this is the only variable part in the set, the slider tunes the frequency of reception.

### ABOUT THE COIL

The wooden coil form is 3 by 1.75 by 0.4 inches. The coil is centered longwise on the form and has 210 turns of 10 mil enameled wire. I estimated the inductance of the coil by equating the area of the opening at the end of the wooden form with that of a cylindrical coil. Hence,

$$a * b = \pi r^2, \text{ so rearranging, } r = \sqrt{\frac{a * b}{\pi}}$$

$$\text{so } r = \sqrt{\frac{1.75 * 0.4}{\pi}} = 0.45 \text{ inches.}$$

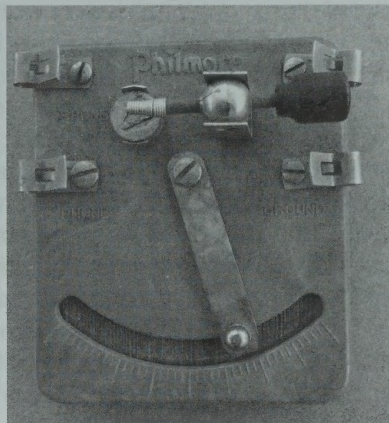
Using Wheeler's equation for a cylindrical coil with a radius of 0.5, 210 turns and a pitch of 0.012 inches, the inductance is roughly 371 uH (micro-Henry). I used about 2/3 of the coil to tune in KLWN at 1320 kHz. That seems about right. Keep in mind that the length of your antenna will determine the capacitance of the tuned circuit.



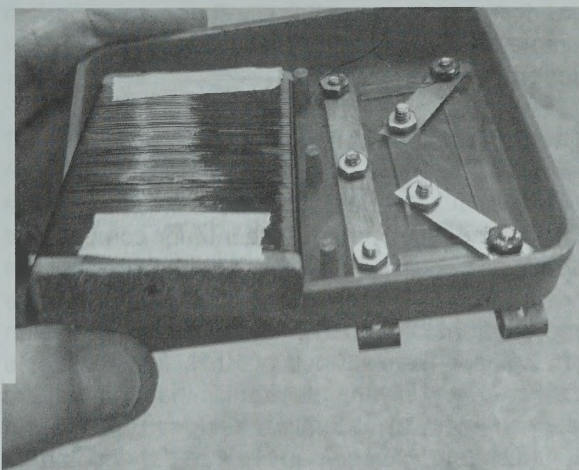
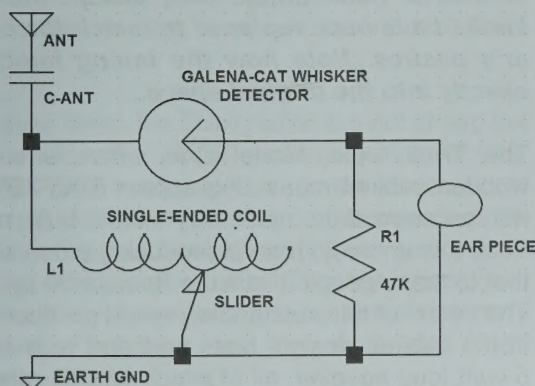
I've drawn the set schematic. Any antenna – usually 40 to 50 feet of wire – for the AM band is short compared to the wavelength of the radio waves in the AM band; hence, the impedance of the antenna is capacitive and labeled C-ANT. This capacitance and the slider coil make up the tuned circuit for the set. One adjusts the position of the slider to tune the radio to a desired frequency. The galena and rock detector converts the AM radio signal to audio; and, the earpiece produces the audio sound.

It is likely that the crystal ear pieces used in sets today were not available in 1950. Radio hams and short-wave listeners of the time used coil-based headphones. One common brand was Baldwin. The DC impedance of most of those old phones was about 2,000 ohms with an AC impedance of about 10K ohms. These phone, of course are hard to find today. Most sets today make use of cheap crystal ear piece. The ear piece is nothing more than a disc shaped capacitor with one side being a thin metal disk and the other side (of the capacitor) an insulated deposited disc of conducting material. As such it is necessary to add a 47k to 100k resistor in parallel with the ear piece to produce audio.

I operated the set with my 40 to 50 foot attic antenna and received our local 500 watt AM station, KLWN, at 1320 kHz readily. My bench ground has earth ground, obtained from a rod just a few feet outside the window. I did not check the DX performance of this set – i.e. long distance operation. Since the Q of the wooden based coil is moderate one would not expect high performance with the set. But keep in mind, this was a very inexpensive set for its time and likely enjoyed by millions! These sets can still be found for sale via the internet.



Picture 1



Picture 2



## Finding A Suitable Cabinet For Your Home Built Radio

By Bob Helt

One of the most difficult things most home builders encounter is what to do with that working radio chassis with the exposed tuning capacitor to make it look more finished and professionally appearing. It seems like friends and family are a lot less impressed by how well your radio works rather than how it looks. Face it, the bare chassis with exposed tuning capacitor and unbaffled speaker just doesn't impress most folks. It may work great but so many others judge a radio on how it looks as well as how it performs.

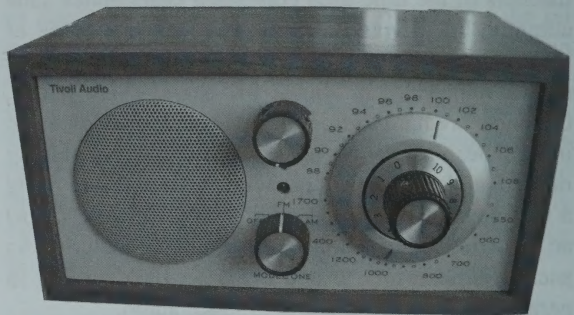
Faced with this problem for many years, I tried many solutions. First was attempting to use several different wooden boxes I located from various sources. Well the boxes did hide the circuit components, but the result still looked amateurish and unfinished. Then I attempted to fit the radio into a purchased Plastic enclosure. This allowed the radios to be more finished looking but still there was that appearance of being unprofessional and obviously home built.

Finally a suggestion on the internet pointed me to the perfect solution. And it may also be a perfect one for you too no matter whether your radio is a simple crystal set or a more complicated TRF or superhet circuit.

### The Perfect Solution

What is this "perfect solution"? It is to use a TIVOLI radio cabinet, gut the interior components and install your radio circuit in its place. What the heck is a Tivoli radio and how might one get one you might ask? The Tivoli was the brilliant design of engineer Henry Kloss of KLH, Inc. fame. He designed not only the electronics that to me seem less spectacular, he also designed the audio cabinetry, and his company has sold them starting around the year 2000 to the present day.

Tivoli Audio offers a wide variety of radios so what you want is specifically a Model One, the basic unit. In addition you should know that there are two versions of the Model One Tivoli. Either one will do for our purposes but you should know just what you are getting. The first version of the Model One has a three position selector switch for Off, FM, and AM. The second version includes these three positions, but adds another switch position for an AUX input. This has importance to us only because of the markings on the front panel and how we will use them.



***This is a Tivoli model one, except that the knobs have been replaced to match the builder's desires. Note how the tuning knob fits exactly into the original space.***

The Tivoli radio, Model One, offers a superb wooden cabinet measuring approx 8"X5"X5" that will accommodate most any home built radio. Then it is an audio marvel producing a rich sound that to many people rivals the Bose radio system. The secret of this outstanding sound producer lies in the cabinet design, bass port and wide-range 5-watt loud speaker, all of which can be retained and used for the home builder's radio. So to start with the basic cabinet with bass port and speaker offers one the perfect choice of a neat looking cabinet with an attractive wooden finish and a professional appearance that is so illusive, plus an unrivaled sound. The Front panel of the Tivoli can also be completely integrated in to the home builder's plans too.



## How to get a Tivoli radio

OK, here's the big secret, both new and used Tivoli radios are sold and bought on Ebay. Just go on Ebay and look for Tivoli Radios (Or Google Tivoli radio and see what is currently offered). Now, new Tivolis are fairly expensive so what you want is a used one, preferable a NON-Working one, since you intend to remove the electronics anyhow. A little known fact is that The Tivoli Audio Company has DECLINED to make public a circuit diagram of their radios. That means that "no one" knows how to repair a non-working unit. Maybe some people can swap working components for failed ones cannibalizing other Tivoli radios but basically a non-working unit can't be repaired. And to complicate that situation, apparently the Tivoli Audio Company doesn't repair failed radios outside of their 2-year warranty either. After their two year warranty expires, they just offer new replacements at a reduced price. It would appear that this inability to repair Tivoli radios aftermarket creates a fairly significant flow of these failed units onto the market for our benefit. So the best thing is to search out a non-working one that can be bought cheaply on Ebay. If you do acquire a working Tivoli radio and don't intend to keep it as an original Tivoli, you might possibly be able to remove the working components and sell them on Ebay.

Yes, even used, the Tivoli radios are not cheap but let's consider the VALUE you are getting for your money. A well made, solid wood sided, acoustical chamber, designed to enhance the sounds emitted from the electronics inside (and yours too). This is with a high quality 3" speaker included. And maybe most important to us, is the very easy conversion to house most any air-variable tuned home-built radio circuit.

## Removing the Old Electronics

The first step is removing the knobs. These are just push-on knobs and no set screws are involved. So wrap masking tape around each knob allowing a length of tape to grab onto and pull. If the tape comes off before the knob, repeat the operation.

Next is to remove the four Philips-head screws located at the corners at the back. Follow this up by removing the two recessed Philips screws at the near center of the back panel. Do not remove any other screws at this time. Now the fun part is pulling out the front panel toward the front and the back panel out the back. These two panels are just a tight fit in the enclosure. Nothing is holding them in place now except friction. So work both of them loose. Don't unplug any cables now.

You can now lay the back panel flat and slide it toward the front panel and remove both panels together from the front of the cabinet. Now unplug the speaker wire.

Remove the front dial, vernier and tuner box from the front panel. Remove the rest of the components from the front panel including the PCB. Remove the components from the back panel. Both the front and rear panels will now be clean. Keep everything you removed all connected together in case you may want to use it in the future or maybe sell it.

## Parts to retain or replace

You want to retain the following parts: Cabinet, Bare rear panel, Bare front panel, Tuning dial, Possibly the tuning knob, All screws and hardware

The following are the specialty parts you want to procure to make this a simple and easily conversion:

A Planetary Reduction Drive (tuning vernier) from The Xtal Set Society (<https://www.midnightscience.com/index.html>).

A front mount air-variable tuning capacitor (VC), either single ganged or dual ganged to suit your needs. These capacitors will have threaded holes on the front side (where the shaft is) for front mounting. Both Single and dual ganged VCs are available



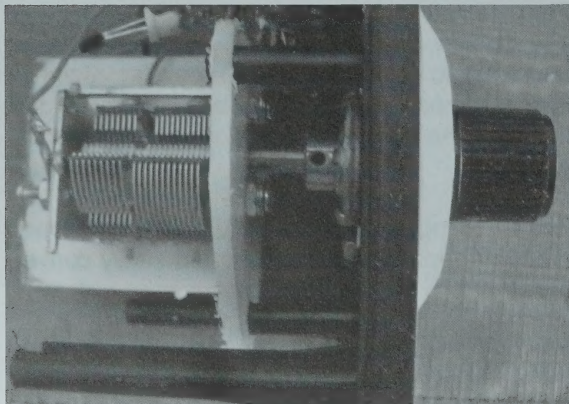
from the Xtal Set Society (<https://www.midnightscience.com/index.html>).

In addition a dual ganged VC (ALPS brand) with two different max capacitances is available on the Internet. Google Alps VC and check Ebay). Also see <[http://www.ebay.com/itm/ALPS-Air-Variable-Capacitor-20-320pf-for-Crystal-Radio-Antenna-Tuner-Ham-Radio-/141381697550?pt=LH\\_DefaultDomain\\_0&hash=item20eb01800e](http://www.ebay.com/itm/ALPS-Air-Variable-Capacitor-20-320pf-for-Crystal-Radio-Antenna-Tuner-Ham-Radio-/141381697550?pt=LH_DefaultDomain_0&hash=item20eb01800e)> There are other sources too.

A 4"X4" piece of 1/8" thick polystyrene sheet or equivalent to mount the VC to.

### Assembly of the specialty parts

Start with the front panel. The new vernier will bolt right in, in place of the old one. So will, the front dial. The tuning knob will not be a direct fit and should be replaced with a purchased one that will fit in the space of the oil one.



*A view of the mounted ALPS dual ganged tuning capacitor. The white platform below the VC is not part of this installation but is the bottom of a proto board, part of the builder's circuits.*

Trim the polystyrene platform to fit over the three tall mounts (or shafts) surrounding the input to the

vernier. Remove the poly platform and carefully drill holes in the poly piece to allow the VC to be front-mounted to it, with the VC shaft aligning with and able to couple to the vernier. Drill holes in the polystyrene platform to align it to these three mounts. Install screws to mount the poly platform with the VC already installed to these three mounts.



*A close-up shot of the VC's mounting on the poly platform and the coupling to the vernier.*

### Finishing the radio

OK, you now have your tuning capacitor mounted and ready to go, along with your speaker. So the rest is up to you. Mount your radio on the two panels and use the two front holes for rotary selector switches, potentiometers, or other controls. You have a lot of opportunities here to build and install so many different circuits and have them all look so good and professional in the Tivoli cabinet.

And as an added note: a little furniture polish will make that wood cabinet shine like it was brand new.



## Installing Xtal Set Antenna and Other Station Parts

By Chip, W7AIT

My next-door neighbor installed my Xtal set society, "50 foot long wire" and 4 foot earth ground rod today. It's not very high, 10 feet and below roof line but it works great! Really pulls in the BBC stations on crystal sets!

The first set I tested was my JFET infinite impedance detector set (modified lm386 audio amplifier and speaker), then my Heathkit cr-1 (copy of the famous Heathkit cr-1 crystal set of 1955 through 1961) with external Pebbles lm386 audio amplifier. The Pebbles amplifier was highly modified by me with 2n2222a transistor preamplifier and now has a selectable gain of 200 or 18,000.



Picture 1: "mid point" of 50 foot antenna wire.



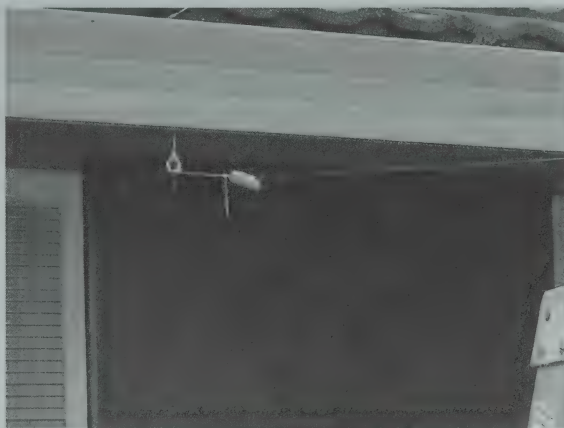
Picture 2: End of Antenna. Note Twist

This antenna is for receiving only, not for transmitting, therefore has no lightening protection features.

I may add a kelvin plate later. I could also neaten up antenna and ground lead in wiring.

A simple wire antenna like this is all it takes to get reasonable performance from crystal sets.

I'll run nighttime testing and see if I can pull in night DX say from KTNB NAVAHO NATION in Window Rock AZ on the New Mexico border, KSL in Salt Lake UT, and KOMO in Seattle.

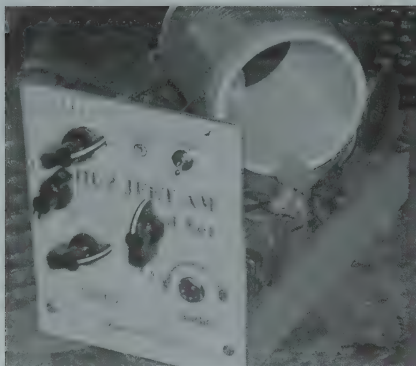


Picture 3: shack end of antenna, strain relief, and loose feedline, headed for shack.

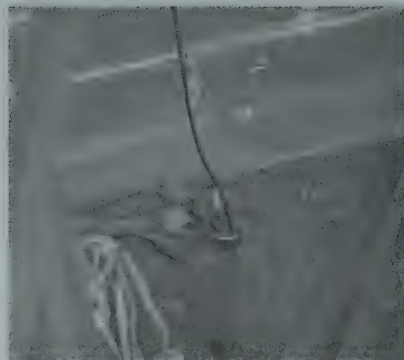


Picture 4: connected to jfet set.





Picture 5: jfet set close up.



Picture 6: xtal ground rod and line

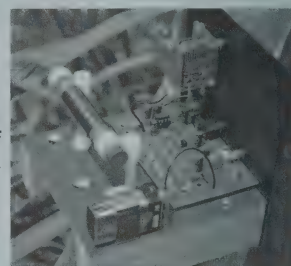
## Xtal Corner: Member Correspondence

### Queen Mum and Phil....

Thought you might like to see what an MK84 kit looks like with a 0.5 X 4.00 in. ferrite rod antenna. I wound it with 60 turns of #22 enamel wire, as you did on the Mini, Phil. I bought the nylon assortment kit from you for the bolts and clamps to hold the ferrite rod. In addition to the 4 inch rod, I bought an additional nylon screw and washer from a hardware store to fasten the main tuning cap more securely and a 6-32X1/8 screw



to fasten the ground lug to the cap frame. I also bought 4-40 bolts and nuts as fasteners along the back edge of the pc board. The only thing I have to do now is blacken the screw heads on the front panel, and take



one or two turns off the ferrite rod. Because of the extra length, there is a little more inductance which moved a few of the stations at the top of the band out of reach with the tuning cap. But, other than that...THIS RADIO REALLY WORKS WELL!!!

I'm going to wind some more antenna coils. I think I want to try one with Litz wire. I love playing with this little radio. There is a lot to experiment with.

So...Queen Mum and Uncle Phil...Keep up the great work! And keep those fantastic kits coming!

Thanks much, Doug Howe



Phil ---

Several months ago, I built an RX3 ultrasound unit with the 12-inch parabolic dish. There are plenty of bats here in San Antonio, but during the past few weeks they have been flying around the street lights in large numbers. My wife and I get a big kick out of listening to them, most of which are Mexican free-tail bats. One of the interesting things that we've observed is that they emit a series of clicks; however, we've noticed that the frequency of these clicks often increases suddenly. Presumably, the frequency of their clicks increases when they lock onto an insect. Amazing stuff. Don Smith  
San Antonio, Texas

Yup. You sure are in Bat Country.

I ran across an interesting article about a year ago, wherein researchers mapped the flights of bats during hunting and recorded their clicking. It turns out that if they skim the water in a lake hunting for food, they give up if the water surface is rough due to wind, since the radar pulse (so to speak) that they send out comes back scrambled. Makes sense. Nice to hear from you. Phil, W0XI

Hello:

I would like to know the full range of capacitance of your 365 PF air tuning capacitor. I am guessing the minimum capacitance is around 10 PF but would like to really know the actual capacitance. I am planning and looking forward on making a crystal radio receiver as a project for some of my grandsons which was a project I had when in my younger years that brought me great excitement. Thanks! Steven W. Brown WB3DYZ

Hello Steven,

I just measured two of them

min 20    max 402

min 22    max 398 pf

This is pretty typical and of course, being mechanical each piece will vary a bit.

I used my BK Precision C meter to check them; this too has a bit of variation. 73, and enjoy Phil Anderson, W0XI

From Ken Ladd

While looking for a crystal set to build for Northland Antique Radio Daze I decided to build a version of Dave Schmarder's No. 23 which incorporates variable coupling between stages and is actually two radios in one. The second stage is a set by itself. See <http://makearadio.com/crystal/23.php>.

I used the Society's spider forms and could not resist mounting them in a DVD case for Radio Days the movie. They open and close with a ball chain drive using vintage wooden thread spools (mom was a pack rat). About the time I was settled on what I was going to do my friend Del gave me a copy of the November 1936 issue of Radio Craft with a South American crystal set with a small variable capacitor between the primary and secondary coils which I just had to incorporate. (See circuit1)

Taking Grandpa Phil's advice I tapped both coils. For the tap switch contacts I used spent brass rifle shell casings which look cool and work well. I bought some Radio Shack plastic base double pole double throw knife switches and used a hacksaw to separate them into single pole.

I used the last two of my gear reduction linear variable capacitors with vintage door knobs with a CD disk hot glued to the base mirror side out. I call it my 3 ½ radio because of the three circuits and a look like a bad knock off of an Atwater Kent breadboard set.

It tunes local stations from 690 to 1500 with pretty good separation. There are enough knobs and switches to keep one quite busy.

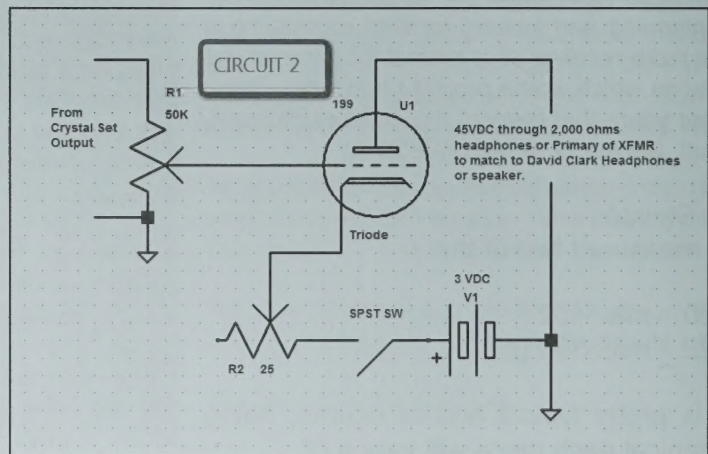
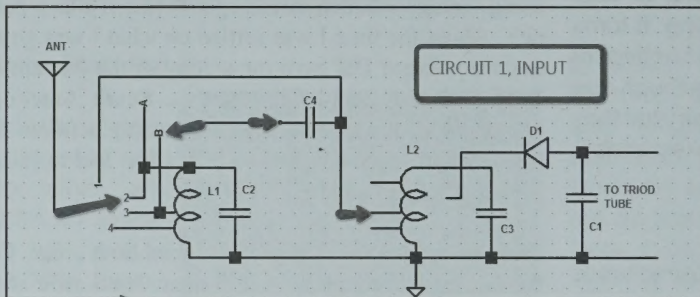
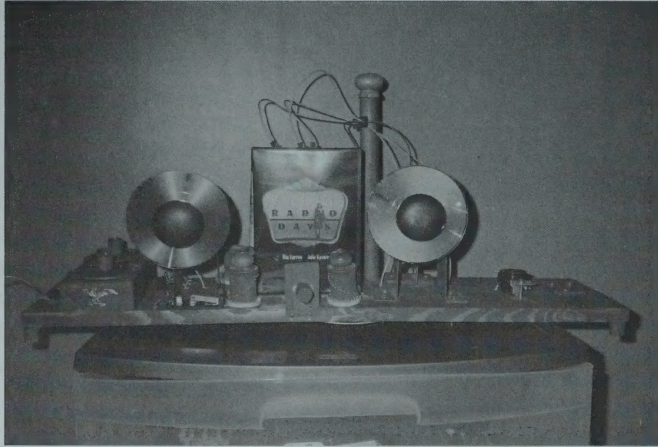
I went on to build a one tube amplifier with a vintage 199 tube and socket that I got from Del. The three volt battery is made from a vintage cartridge fuse holder



that I stretched open enough to hold four C cells. The B plus supply is a series of nine volt batteries mounted in a vintage wooden Blue Moon Cheese box. The amplifier feeds into another vintage wooden box that houses a universal output transformer and another shell

casing switch to match a variety of output devices. (See circuit 2)

Next May's set is forming in my mind and if it works like I hope it will be one of those first time ever sets.





Once again society members bring you ideas and instructions for a variety of crystal radio projects. This book contains projects and theory about crystal radio including: The Magic Reynolds Wrap Attic Antenna and instructions for building your own basket weave coil mandrel. The secret life of detectors is revealed in John Davidson's seminal article presented here with parts 1 and 2 together. 8 1/2 X 11, Comb bound. Cat # xv15 \$12.95

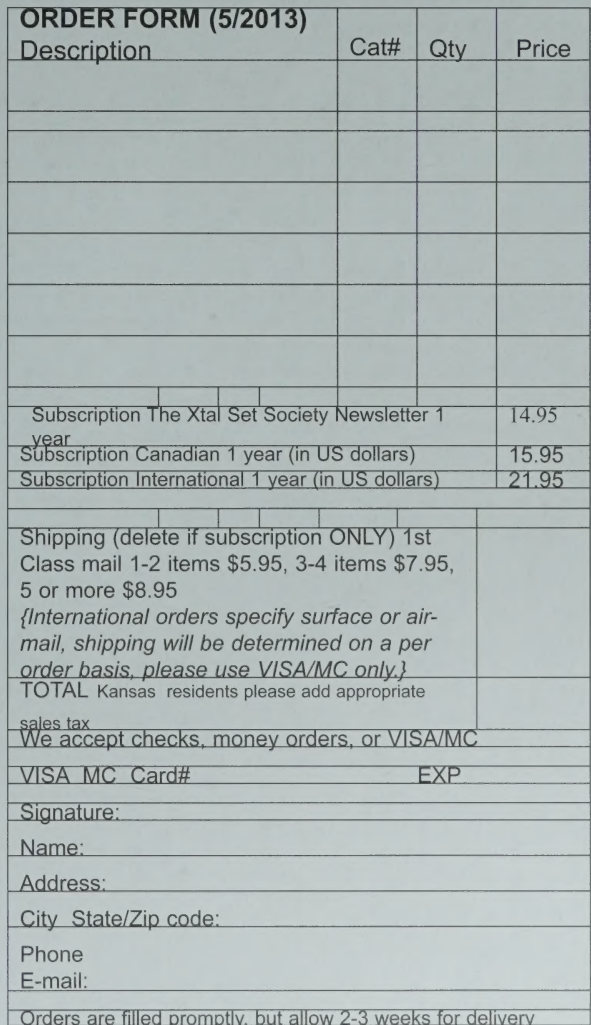
Just when you thought the projects were over, here's a new batch. Again society members bring you ideas and instructions for a variety of crystal radio projects. These are gathered from the 2006 & 2007 newsletters! H.P. Friedrichs introduces his "Tea Time" Headphones (constructed in a pair of little tea boxes). There's a variable-coupled basket weave coil, Dan's Fruit of the Loom Set (a basket of Litz of course), Mike's 1-Tube Low Voltage DXer Set (3Q4), stuff about Toroids, Patron's Modern Armstrong Regen RX, stuff on detection, Spider coils from Dan, the Xtal High Voltage Contest Entry winner, a calibrated capacitor, Phil's Crazy-L Attic Antenna, Alex Jueschke's homebrew loopstick coils (from magnet ore sweepings), a rare picture of Joe Eisenberg of Nebraska ( ! ), another regen rig, Phil's crazy AM Chopper Modulator, a sampling of member correspondence, and more! 8-1/2 by 11, 100 pages, Comb bound. Cat# XV17 \$15.95

Learn about using audio transformers from Phil, building a basic grid leak from Dan, and how to build a homemade flame triode from Nyle Steiner. These ideas and many others are from the 2008-2009 newsletters. In the 2009 section, you will see Dan's one-FET set, and an antenna tuner for your crystal radio. Dennis Baker shows us a radio on a stick. 8 1/2 by 11 with 118 pages, Comb Bound. XV19 \$16.95.

This edition marks 20 years of the Crystal Set Society. Many thanks to all our members for twenty years of fun with radio. The compilation includes the articles from the 2010 and 2011 newsletters, including: Fun With Homebrew Cuprous Oxide Diodes; Resistance of Hardboard; The Telefunken Crystal Set; Two Popular AM Loop Antennas; Diode Biasing; Ultrasound Pressure of a Weak Spark; The Old Timer - Regeneration; The Antenna Tutorial I, II & III; Crystal Radios Are Like Beer; A Trap Antenna; Simple Circuits for Quality Sound; Audio Regeneration; Powered by Fleming's Amazing Valve; Two JFET Crystal Sets, From the Mailbox of Prof Verruckt, The AM Antenna Tuner Kit, and more. 8-½ by 11 with 115 pages, Comb Bound. Cat#XV21 \$16.95.

This small booklet is written in easy to read language for the true beginner to our wonderful hobby. It has pictures and symbols for basic parts and gives the reader basic information to get started with that first building project.

5 1/2 X 8 1/2 15 pgs  
**Cat# XBGN \$2.95.**





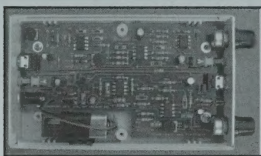
## Grounding Kit



This kit is ideal for use with our Crystal Radio Antenna Kit or for general station grounding. It consists of a long-lasting 2.5 by 1/2 inch galvanized ground rod, 1/2-inch brass rod clamp, ten feet of #14 Insulated Stranded copper antenna wire and an instruction/installation sheet. The grounding kit provides for an outside grounding circuit for your crystal radio. The antenna wire is very flexible, allowing you to loop it under your window at the sill and then simply closing the window.

Grounding Kit Catalog # Grd-K \$19.95.

## CW REGEN FILTER, (Alias: The Scrubber)



This kit was inspired by the inhibiting galactic noise encountered when listening to HF CW. Many proficient CW operators turn the AF gain full on and manage the audio signal and noise with internal rig filters and the RF gain knob.

Even with these techniques band-limited cosmic static is present along with some man-made noise. There isn't much one can do to copy CW notes that are simply too weak; but, one can scrub away a portion of the static that makes its way into our consciousness with an audio regenerative filter. (See the feature article on the CW Scrubber in November, 2012 CQ Magazine.)

For example, when tuned to a quiet spot on 30-meters, regen's output shows a reduction in noise compared to the signal at the phone jack of the receiver. In bypass mode one simply listens to what the rig has to offer. In scrubber mode, the multiple-op-amp filters and regen work together to remove a majority of the remaining white noise. The processed signal sounds clean with a slight echo-chamber quality. For most this is an improvement, reducing stress and improving copy.

For experienced kit makers, assembly and alignment is about two hours. You can use a meter or scope to align the filters and the audio delay line. If you have neither of these you can align the filter by ear. If you don't have a signal generator, you can use CW from your rig, a code oscillator or download 600, 700, and/or 800 Hz wavefiles from our "downloads" webpage. In addition, you'll supply the connectors and cabling for your specific radio and the following tools and supplies: pliers, cutters, knife or wire stripper, soldering iron & solder, masking tape and your enthusiasm! The filter can be supplied with a well regulated and grounded +12VDC supply or 9V battery. A well grounded station is necessary when external high gain audio-based accessories are added to prevent or substantially reduce any "ground loop" interference. The populated PCB fits in a plastic case that is W 3.700, H 1.450, and L 6.100 inches.

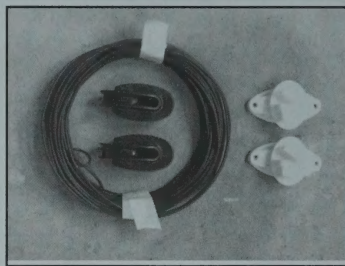
**CW REGEN FILTER KIT, PCB & MANUAL ONLY 29.95**

**CW REGEN FILTER KIT, NO CASE 49.95**

**CW REGEN FILTER KIT WITH CASE 69.95**

## Crystal Radio Antenna Kit

This kit consists of 50 feet of #14 AWG insulated and stranded copper antenna wire, two nail insulators, two antenna insulators and an instruction and installation



sheet. The instruction sheet outlines how to install the antenna for the AM band.

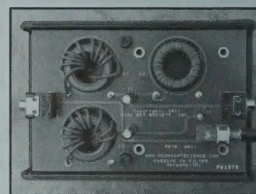
The nail insulators mount with two wood screws and provide for wire

support near the window and at a tree or eve. Weave the wire through the "claws" of the nail insulator to hold it in place. The antenna insulators may be used with rope on one side and as a tie-off for the antenna wire on the other side. These are shown in the picture inside the 50' loop of wire. Since the wire is flexible, you can easily place it on your window sill and close the window. Crystal Radio Antenna Kit Cat #Ant-k \$19.95

## Passive Audio CW Filter Kit

Our Passive Audio CW Filter Kit was inspired by our enthusiasm for non-powered – no batteries or power supplies required – electronics. The kit features a 250 Hertz (Hz)

bandwidth, 700 Hz center-frequency, 8-ohms in, 8-ohms out audio filter, designed for CW operation. A bypass switch allows for bypass and in-line reception comparison. The unit installs between your receiver's headphone jack and headphones or speaker. Assembly for experienced kit builders is less than an hour. The kit consists of eleven parts, including three high-mu ferrites, quality PCB and black plastic case. Instructions are included for changing the filter bandwidth to 500 Hz for CW or 1500 Hz for SSB; for either of these frequency bandwidths the number of winding per core must be changed and a different set of capacitors purchased.



The kit can accommodate other center frequencies and bandwidths. To calculate the number of turns for the cores (coils) and the capacitor values required download these files: [manual addendum](#) and [filter calculator](#) spread sheet (xls).

Passive Audio CW Filter Kit, with PCB & CASE 36.95